CLAIMS

I/We claim:

1. A communication system, comprising:

multiple transmitters configured to transmit and retransmit data packets and associated control information, wherein:

the transmitters use subchannels comprising groups of subcarriers;

the transmitters are capable of switching [hopping] to another subchannel and reconfiguring in any of or a combination of signal domains, for retransmission of a packet, based on received channel condition information;

the control information includes information concerning modulation schemes, coding rates, pilot patterns, training symbols, power levels, spatial processing schemes, modulation constellation arrangements, transmitter antenna techniques, subchannel configurations in a multi-carrier system, or any combination thereof; and

a hybrid ARQ (automatic repeat request) scheme is utilized for at least one of the subchannels; and

multiple receivers configured to receive the data packets and the associated control information, wherein:

the receivers are configured to feed back channel condition information, comprising channel measurements or channel quality indicator (CQI), along with an Acknowledgement/Negative-Acknowledgement (ACK/NACK) signal to assist the transmitters to select, reconfigure, or select and reconfigure a subchannel for retransmission of a failed packet or transmission of a next packet; and

the channel measurements or the channel quality indicator (CQI) carries information about: received signal strength, average SINR (signal to interference plus noise ratio), variance in time, variance in frequency, variance in space, BER (bit error rate),

FER (frame error rate), or MSE (mean square error), or any combination thereof, based on the received signals, the control information, or both.

2. The system of claim 1, wherein:

the transmitters implement a hierarchical ARQ process for a packet stream;

the ARQ process includes an outer loop and at least one inner loop;

the outer loop operates at a higher layer with a traditional ARQ approach;

the at least one inner loop operates at a lower layer with one of the hybrid ARQ methods;

parameters for both the outer and the inner loops can be changed depending on applications or unit processing capabilities;

a number of retransmissions within the inner loops is set smaller for delay-sensitive applications than for delay-insensitive applications; and

the outer loop is removed for delay-sensitive applications.

3. The system of claim 1, wherein:

at least one subchannel is reserved for retransmission of failed packets;

at least one of the transmitters randomly selects one of the subchannels for retransmission; or

at least one of the transmitters, based on the channel condition information of all or some of the subchannels, selects a subchannel for retransmission to optimize system efficiency.

4. The system of claim 1, wherein:

at least a first subchannel and a second subchannel are allocated for transmission; and

upon receiving a Negative Acknowledgement (NACK) signal indicating need for retransmission of a packet originally sent over the first subchannel, at least one of the transmitters swaps transmission of the first and the second subchannels and sends the packet to be retransmitted over the second subchannel.

5. The system of claim 1, wherein:

multiple subscribers share one subchannel through time division multiplexing; and

multiple ARQ processes, each corresponding to a subscriber, are carried out in parallel.

6. The system of claim 1, wherein the transmitters and the receivers are at least part of base stations and mobile stations in the system, and wherein the transmitters can change the subcarrier composition of a subchannel to contain a different ensemble of subcarriers and/or different training pilots.

7. The system of claim 1, wherein the receivers combine an originally transmitted signal and a retransmitted signal, which are transmitted over same or different subchannel, to detect data packets.

8. A wireless multi-carrier packet communication apparatus, comprising:

at least one transmitter configured to transmit information packets, using subchannels comprising groups of subcarriers;

at least one receiver configured to receive the transmitted packets;

wherein the at least one transmitter switches from a subchannel to another subchannel and reconfigures the other subchannel for retransmission of a packet signal in any of, or a combination of, variables by which the signal is defined;

wherein the at least one receiver is configured to send back channel condition information and an Acknowledgement/Negative-Acknowledgement (ACK/NACK) signal to assist the transmitters select and reconfigure one of the subchannels for retransmission of a failed packet or transmission of a next packet; and

wherein the at least one transmitter is further configured to employ a combination of FEC (forward error correction) and ARQ (automatic repeat request) schemes.

9. The apparatus of claim 8, wherein the at least one transmitter and the at least one receiver are parts of base stations and mobile stations and wherein reconfiguring a subchannel for retransmission of a packet includes modulation schemes, coding rates, pilot patterns, training symbols, power levels, spatial processing schemes, modulation constellation arrangements, transmitter antenna techniques, or a combination thereof.

10. The apparatus of claim 8, wherein the at least one transmitter is configured to change subcarrier composition of a subchannel to contain a different ensemble of subcarriers and/or different training pilots.

11. The apparatus of claim 8, wherein:

at least one transmitter randomly selects an available subchannel for retransmission; or

at least one transmitter, based on the channel condition information of all or some of subchannels, selects a subchannel for retransmission to optimize efficiency.

12. The apparatus of claim 8, wherein at least one subchannel is reserved for retransmission of failed packets.

13. The apparatus of claim 8, wherein at least one measure is taken to improve a channel condition of the at least one reserved subchannel.

14. The apparatus of claim 8, wherein the at least one transmitter uses modulation/coding/power schemes that matches channel qualities of corresponding subchannels, in which case retransmitted packets are fitted into subchannels by rate matching.

15. The apparatus of claim 8, wherein:

at least a first subchannel and a second subchannel are allocated for transmission; and

upon receiving a Negative-Acknowledgement (NACK) signal indicating a need for retransmission of a packet originally sent over the first subchannel, at least one of the transmitters swaps transmission of the first and the second subchannels and sends the packet to be retransmitted over the second subchannel.

16. The apparatus of claim 8, wherein:

retransmission over a subchannel uses same settings as a previous transmission over that subchannel; and

rate-matching is employed to fit current retransmitting packet onto same subchannel when current transmission packet size is different from previous transmission packet size on same subchannel.

17. The apparatus of claim 8, wherein the at least one transmitter stays on original subchannel for retransmission if:

there are no other subchannels available to the at least one transmitter at the time of retransmission;

the at least one transmitter has knowledge that a quality of original subchannel is better than or as good as the rest of available subchannels; or

the quality of original subchannel is sufficient to support a high modulation/coding index.

18. The apparatus of claim 8, wherein:

multiple subscribers share one subchannel through time division multiplexing; and

multiple Automatic Repeat Request (ARQ) processes, each corresponding to a subscriber, is carried out in parallel.

19. The apparatus of claim 8, wherein some information about retransmission process is embedded in a header of each retransmitted packet.

20. The apparatus of claim 8, wherein:

the apparatus implements a hierarchical Automatic Repeat Request (ARQ) process for a packet stream;

the ARQ process includes an outer loop and at least one inner loop;

the outer loop operates at a higher layer with a traditional ARQ approach;

the at least one inner loop operates at a lower layer with one of the combination methods of FEC (forward error correction) and ARQ (automatic repeat request); and

parameters for both the outer and the inner loops can be changed depending on applications or unit processing capabilities.

21. The apparatus of claim 8, wherein retransmission process continues until a packet is successfully received or a pre-specified number of retransmissions is reached.

22. The apparatus of claim 8, wherein signal variables comprise time, frequency, space, signal power, modulation, or coding.

23. A wireless packet communication method in a multi-user, multi-cell environment, the method comprising:

transmitting a signal indicating a need for retransmission of a failed packet;

receiving a retransmitted packet and associated control information signals, wherein the retransmitted packet is received over a subchannel that differs from an original subchannel over which the failed packet was transmitted;

measuring channel conditions based on received signals; and

feeding back the channel condition measurements, or a channel quality indicator computed based on the channel condition measurements, or both, for use in reformation processes, wherein the reformation processes include subchannel switching and at least one hybrid ARQ (automatic repeat request) scheme.

24. In multi-receiver wireless communication network, an apparatus comprising:

means for reconfiguring subchannels for retransmission of failed packets, in any or any combination of signal domains;

means for switching subchannels for retransmission;

means for generating control information signals comprising reconfiguration information;

means for transmitting the failed packets and associated control information over reconfigured subchannels;

means for receiving fed back information relating to channel condition measurements, or a channel quality indicator computed based on the measurements, or both, for use by the means for reconfiguring, wherein the means for reconfiguring includes a means for performing a combination of FEC (forward error correction) and ARQ (automatic repeat request) processes.